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ACREAGE OF SHORTLEAF PINE AFFECTED BY LITTLELEAF DISEASE

by

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Abstract

Using published data, the acreage of shortleaf pine affected by littleleaf disease is estimated to be 1,395,100 acres. With acreage of host type as the basis, a method to project the affected acreage is described.

INTRODUCTION

Littleleaf disease is the most damaging disease of shortleaf pine (Pinus echinata Mill.). This disease is caused by a complex of factors including the fungus Phytophthora cinnamomi Rands., poor site (especially nitrogen deficient soils which have been eroded), nematodes, and fungi in the genus Pythium. While adequate descriptions of this disease are found in pathological literature, no recent loss assessment data are available.

To provide loss estimates for littleleaf disease for the Forest Insect and Disease Information System (FIDIS) (FSM 3450) a procedure was devised which uses data from a variety of sources. Published reports of the USDA Forest Service Renewable Resources Evaluation (RRE) groups in Asheville, NC, New Orleans, LA, and Broomall, PA were the primary sources for these data. Within the limitations of RRE timing of surveys, this method allows easy updating as new information is collected.

The information presented here for FIDIS Level I is a breakdown of acres of shortleaf pine infected severely enough with littleleaf disease that forest management was affected. This acreage is further broken down by state and ownership class.

In order to project these values, a number of assumptions had to be made. The method developed plus the assumptions (and their limitations) are detailed below.

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METHODS AND MATERIALS

The littleleaf disease range map, published by Copeland & Campbell (2), has not been significantly revised since publication. That map is presented in figure 1. By superimposing this map over a map of Southeastern counties, a listing of counties located within the boundaries of the disease range was compiled. Those counties having their land area more than 1/2 within this zone are included in table 1.

Land area statistics were tabulated from RRE Resource Bulletins (1, 3, 4, 5, 6, 7, 9, 10, & 12). There was a difference in the method of recording ownership between Southeastern (SE) and both the Southern (SO) and Northeastern (NE) Forest Experiment Stations. SE information was condensed to fit the more generalized SO and NE headings where necessary (i.e., values for Misc. Federal, State, and County and Municipal were combined into "Other Public" and the SE Corporate and Individual Private categories were combined into the SO/NE Miscellaneous Private category). Acreage data (from tables 1-4 in the reports from SE and SO RRE) were compiled by ownership within each county.

Since both SE- and SO-RRE report only a mixed loblolly-shortleaf type (acreages of the two species combined), it was necessary to separate the respective acreages for these two species. This was accomplished using Nelson & Zillget's Atlas (8). Assuming that the volume distribution shown in the Atlas of loblolly and shortleaf pines would be similar to their species distribution, then counts of volume dots for shortleaf and loblolly pine on these maps (within the disease range and state by state) should represent the relative acreage occupied by these two species within the mixed population. (Loblolly/shortleaf acreages are not separated by RRE on a county-by-county basis). Figure 3 presents a summary of the proportion of loblolly and shortleaf pine within each state based on this dot count. Using the percentages from figure 3 it was possible to assign relative land areas to shortleaf and loblolly pines within those counties affected.

Data for Kentucky were derived from Kinglsey and Powell (5). Using data for the state, county, or the Southern Cumberland as appropriate, tables 2, 9, 10, 32, and 73 were used. Separation of National Forest lands was accomplished using a Forest Service statistical summary (11). The remaining forest land in McCreary and Whitley Counties was arbitrarily apportioned to ownership category using land ownership percentages for the Southern Cumberland area drived from table 32 (5).

Figure 2 of this report shows state-by-state acreage totals for forest land by ownership and host type.

Along the bottom lines in figures 2 & 3 are letters from A to M. Figure 4 presents the formulae which were used to convert the data presented in figure 2 to the data presented in figure 5--data specific to shortleaf pine. The use of the value for pole and sawtimber as the basis for affected acreage results from the fact that larger trees which are undergoing competition for root space are more susceptible to littleleaf

than smaller trees. While 20+ years old is the figure usually given for increased susceptibility to this disease (2, 13), the only available data breakdown reflective of this age was the pole/sawtimber versus the seedling/sapling categories.

Finally, assuming that the distribution of littleleaf occurs uniformly, irrespective of ownership, Zak's (13) projection of 33% of the shortleaf within the disease range being affected to such a degree that "the disease is a major factor in timber management" was applied to the values in figure 5 to generate figure 6.

RESULTS AND DISCUSSION

Figure 6 presents a tabulation of acres of shortleaf pine affected by littleleaf disease separated by ownership and state. This satisfies the requirements for FIDIS level I data. Overall littleleaf disease is severe enough to affect management on 1,395,100 acres in the South.

The following assumptions were made when calculating the affected acreage:

1) The disease influence on loblolly pine cannot be evaluated.

2) Volume dots in the Nelson and Zillget Atlas (8) for each species can be converted accurately to values proportional to the acreage occupied by the loblolly and shortleaf pine components of the reported loblolly-shortleaf type.

3) Distribution of littleleaf disease is uniform despite ownership.

4) Zak's (13) percentage of affected land is both accurate and can be applied uniformly throughout the littleleaf range.

Assumption 1 -- While fair documentation exists relative to this disease as it affects shortleaf pine no information is available as to the extent of damage to loblolly pine. Literature references to loblolly pine generally suggest that it is "less affected" than shortleaf pine, but neither the degree of resistance nor the duration or intensity of damage are documented for this alternative host. Zak (13) shows a mortality ratio of 5 shortleaf:3 loblolly for selected plots, but does not generalize from this number. Should estimates of the damage to loblolly become available, they could be applied to acreage values for that component of the mixed type in the same manner as has been done in this paper to the shortleaf pine component. This inability to project affected acreage for loblolly pine has lowered the overall "affected acreage" estimate but has not influenced that made for shortleaf pine.

Assumption 2 -- This assumption includes several silvicultural assumptions which cannot be easily verified. Among these are the assumptions that shortleaf and loblolly pines exist at the same density, that both grow at the same rate (volume per year), same form factor, and that, throughout the area under consideration, mortality and other volume losses (culling damage, etc.) will be equal for both species. This series of assumptions

allows us to assume that equal volumes of growing loblolly and slash pines require equal acreage on which to grow. If this last assumption holds up, then a dot count on the Atlas (8) maps will give proportional values valid for projecting percentages of area for the two species.

Assumption 3 - This assumption is somewhat suspect since overfarming an area is the best way to ruin the soil. Often, overworked farmland provides the eroded, nitrogen deficient land which is the prime site for littleleaf disease. It is questionable that the Forest Service has an equal percentage of this land when compared with the private sector (commercial and non-commercial). However, there are no available data to establish ownership distribution of high hazard littleleaf sites.

Assumption 4 - This assumption is by far the least supported. In fact, the only support for it is an expert opinion presented by Zak (13). This opinion was based on experience and is not presented with data which support its applicability throughout the disease range. Further, it was presented as a generalization (appropriately applied to the total line), but may be misapplied when used on the individual state totals. One indication of this problem is the map presented by Campbell & Copeland (2) showing high hazard zones for littleleaf. Assuming the accuracy of this map then the application of the percentage value on a state-by-state basis is inaccurate. However, there is no statistical way to partition this percentage, so it has been applied uniformly over the disease range.

One other problem with this assumption is that FIDIS I data were to reflect all affected acres while FIDIS II data were to have an impact ("so as to affect management") condition included in the computation. Thus, use of 33% probably gives a conservative estimate of acres affected since it excludes minor areas of infection.

Ideally, littleleaf disease will continue to be reported (along with several other diseases) by the NE-, SE- and SO-RRE groups. It is now felt that the values generated through these surveys will, for a variety of reasons, be conservative. The difficulty of diagnosing this problem, combined with the current RRE "most damaging agent" concept, will cause much of this damage to be unreported, or, be attributed to another cause. The method presented, while based on assumptions, allows us to project from RRE data for host type, which appears to be a more reliable projection than direct use of RRE data for littleleaf disease.

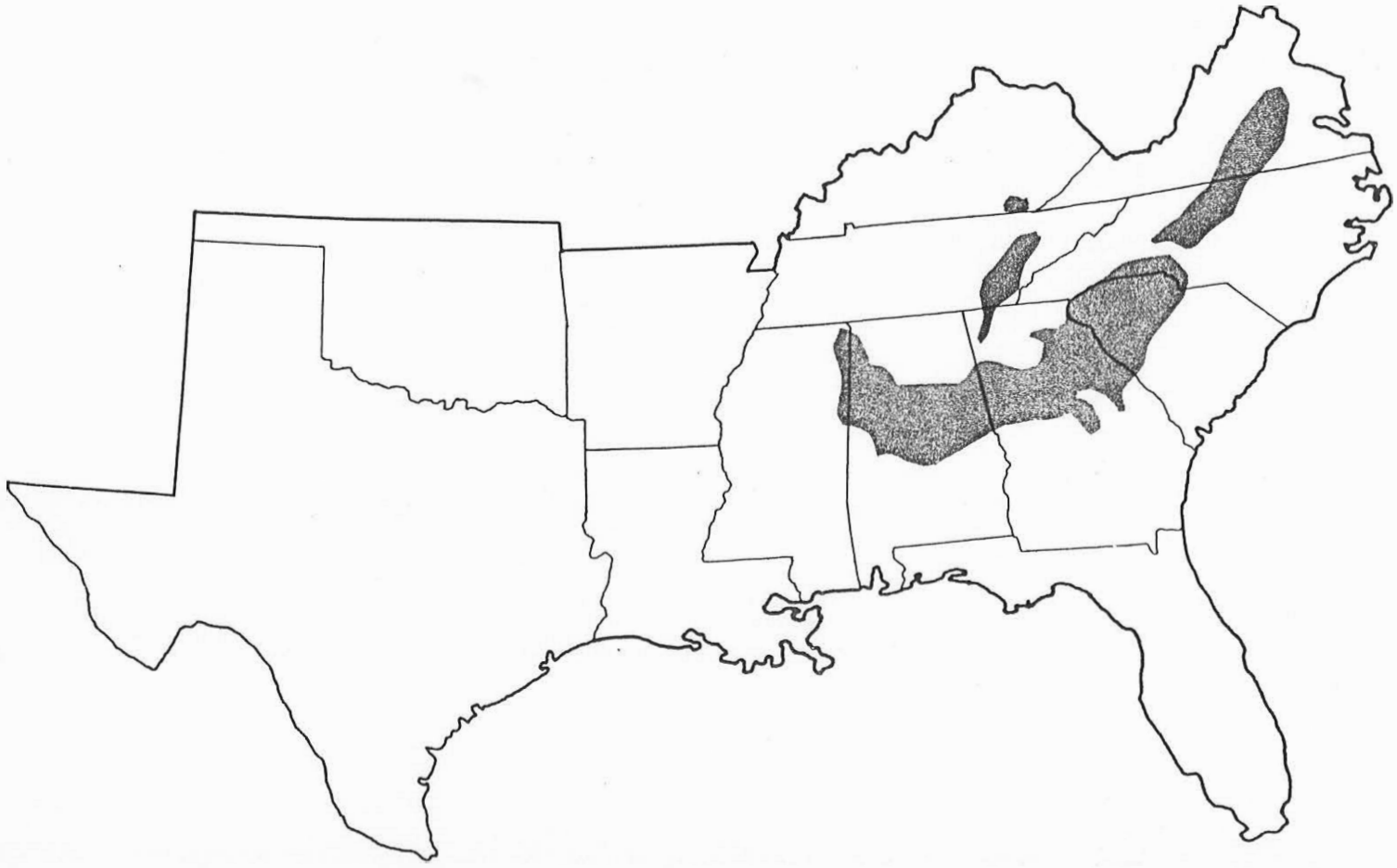

Figure 1. Range of littleleaf disease of shortleaf pine [adapted from Campbell (2)].

Table 1. Listing of counties included within the range of littleleaf disease shown in figure 1.

Alabama	Georgia	Kentucky
Autauga	Baldwin	McCreary
Bibb	Banks	Whitley
Calhoun	Barrow	North Carolina
Chambers	Butts	Almance
Cherokee	Carrol	Caswell
Chilton	Clarke	Cleveland
Clay	Clayton	Davidson
Cleburne	Cobb	Davis
Coosa	Columbia	Gaston
Fayette	Coweta	Guilford
Franklin	DeKalb	Lincoln
Greene	Douglas	Mecklenburg
Hale	Elbert	Orange
Jefferson	Fayette	Person
Lamar	Floyd	Polk
Marion	Franklin	Randolph
Perry	Fulton	Rockingham
Pickens	Glascock	Rutherford
Randolph	Greene	Tennessee
St. Claire	Hall	Blount
Shelby	Hancock	Granger
Talladega	Haralson	Knox
Tallapoosa	Hart	Loudon
Tuscallosa	Heard	McMinn
Walker	Henry	Meigs
Mississippi	Jackson	Polk
Itawamba	Jasper	Roane
Lowndes	Jefferson	Union
Monroe	Lincoln	Virginia
Noxubee	Madison	Appomatox
Prentiss	McDuffie	Buckingham
Tishomingo	Meriwether	Campbell
South Carolina	Morgan	Charlotte
Abbeville	Murray	Cumberland
Anderson	Newton	Fulvanna
Cherokee	Oconee	Goochland
Chester	Oglethorpe	Halifax
Edgefield	Paulding	Louisa
Fairfield	Pike	Powhatan
Greenville	Polk	Prince Edward
Greenwood	Putnam	
Laurens	Richmond	
McCormick	Rockdale	
Newberry	Spaulding	
Oconee	Stephens	
Pickens	Taliaferro	
Saluda	Troup	
Spartanburg	Walton	
Union	Warren	
York	Wilkes	
	Wilkinson	

STATE	THOUSANDS OF ACRES									
	Ownership Class							Species & Size Class		
	All For.	N.F.	Other Public	For. Ind.	Farm	Misc. Priv.	Non-Comm. For.	Lob-S.L.	Sapl. & Seedl.	Saw. & Pole.
Alabama	8165.5	354.0	146.4	1600.2	2178.3	3879.2	7.4	2899.2	2921.4	4951.3
Georgia	6944.0	163.6	176.4	972.4	2180.6	3431.8	19.6	3474.4	1482.7	5484.6
Kentucky	467.5	192.1	3.7	3.9	102.4	154.5	10.9	167.7	3351.5	8550.4
Mississippi	1157.8	0.0	30.5	153.9	405.0	567.4	1.0	221.2	677.3	479.5
N. Carolina	2503.0	9.4	33.3	54.3	1286.5	1116.3	3.4	827.6	633.8	1842.1
S. Carolina	4292.6	338.6	89.7	567.2	1508.7	1787.7	40.8	2149.1	1036.4	3155.8
Tennessee	1049.3	150.9	66.9	66.2	462.6	302.8	0.0	222.6	410.1	639.2
Virginia	2147.7	0.0	67.9	363.5	963.4	752.1	1.2	675.9	648.1	1473.9
A[1/]	B	C	D	E	F	G	H	I	J	K

Legend:
- All For. = Acreage of all forest ownership.
- N.F. = Acreage of National Forest ownership.
- For. Ind. = Acreage of forest industry ownership.
- Misc. Priv. = Acreage of miscellaneous private ownership.
- Non-Comm. For. = Acreage of private or public forest which is non-commercial.
- Lob.-S.L. = Acreage of loblolly-shortleaf pine type.
- Sapl. & Seedl. = Acreage of all species in seedling and sapling categories.
- Saw. & Pole. = Acreage of all species in saw and pole timber.

[1/] Letters are used in the formulae presented in figure 4.

Figure 2. Acreage of forest within littleleaf disease range separated by state and ownership and considered type.

	Loblolly	Shortleaf
	%	%
AL	61	39
GA	39	61
KY	67	33
MS	71	29
NC	9	91
SC	44	56
TN	10	90
VA	10	90
A[2/]	L	M

2/ Letters are used in the presentation of the formulae in figure 4.

Figure 3. Percentages of each species within the disease range in figure 1 as derived from Nelson and Zillget (8).

State	Shortleaf Pine	Shortleaf Pine Pole & Sawtim.	N.F.	Other Public	For. Ind.	Farm	Misc. Priv.	Non Commerc.
A	P	P x Q	C/S	D/S	E/S	F/S	G/S	H/S

Where for each state's data:

P = I x M = acres of shortleaf pine in the state.
Q = K/B = % of acres in state in pole and saw timber.
R = P x Q = # acres of pole and saw timber sized shortleaf pine in the state.
S = R/B = % of shortleaf pine acreage in pole and saw timber in the state.

Figure 4. Presentation of formulae used to convert loblolly/shortleaf pine acreages to acres of shortleaf pine type in the disease range of littleleaf disease. Letters used in formulae are taken from figures 2 (A-K) and 3 (A, L, & M).

State	Total	Potential Affected	N.F.	Other Publ.	For. Ind.	Farm	Misc. Priv.	Non Comm. For.
	THOUSANDS OF ACRES OF SHORTLEAF PINE							
Alabama	1130.7	685.6	29.7	12.3	134.4	183.0	325.9	.6
Georgia	2119.4	1730.4	39.4	42.5	234.6	582.1	827.1	4.7
Kentucky	55.8	40.1	16.5	.3	.3	8.8	13.2	.9
Mississippi	64.2	26.6	0.0	.7	3.5	9.3	13.0	0.0
N. Carolina	753.1	554.2	2.1	7.4	12.0	284.3	246.7	.8
S. Carolina	1203.5	612.8	69.8	18.5	116.8	31.0	368.3	8.4
Tennessee	200.3	122.0	17.5	7.8	7.7	53.8	35.2	0.0
Virginia	603.3	414.0	0.0	13.1	70.1	185.7	145.0	.2
TOTAL	6730.3	4185.7	175.0	102.6	579.4	1338.0	1974.4	15.6

Figure 5. Acres of shortleaf pine potentially affected by littleleaf disease, presented by ownership and state, within littleleaf disease range.

THOUSANDS OF ACRES

State	Total	N.F.	Other Publ.	For. Ind.	Farm	Misc. Priv.	Non Comm. For.
Alabama	228.5	9.9	4.1	44.8	61.0	108.6	.2
Georgia	576.8	13.1	14.2	78.2	194.0	275.7	1.6
Kentucky	13.4	5.5	.1	.1	2.9	4.4	.3
Mississippi	8.9	0.0	.2	1.2	3.1	4.3	0.0
N. Carolina	184.7	.7	2.5	4.0	94.8	82.2	.3
S. Carolina	204.1	23.3	6.2	38.7	10.3	122.8	2.8
Tennessee	40.7	5.8	2.6	2.6	14.6	11.7	0.0
Virginia	138.0	0.0	4.4	23.4	61.9	48.3	.1
TOTAL	1395.1	58.3	34.3	193.0	442.6	658.0	5.3

Figure 6. Level I FIDIS projection of acreage of shortleaf pine affected by littleleaf disease in the South.

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